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Science and Art Gossip.

SOME of our professedly religious papers are either illogical or rather uncharitable. The Newton of biology says (as *we* have said, by the way, since KNOWLEDGE was started) that science has nothing to do with the Christian (or any other) religion; *therefore*, say they, Darwin objected to Christianity: This is akin to Pat's logic—"Is not one man as good as another?" said the orator. "Of course he is," *acquiesced* Pat (as he thought), "and a good deal better."

BUT Darwin accepted no revelation, *therefore* either he was an atheist or had unworthy thoughts of God. How if the reverse were the case? if Darwin knew of no words ever written by man which he thought worthily represented a Being infinitely beyond man's conceptions? How if he agreed with Elihu, described as approving of Yahveh, in believing that "As touching the Almighty we cannot find Him out?" He may not have understood the Oriental imagery which ascribes to the Creator the qualities of Oriental despots. His mind, of essentially Western constitution, may not have been able duly to grasp these ideas. There are others equally unfortunate; but we ought not to be angry with them.

DR. FREEMAN says in *Longman's Magazine* that some features of American pronunciation are to be explained by the habit of forming an idea of the pronunciation of words from their appearance as printed. In illustration of this we note that we have heard Burns's line, "A man's a man for a' that," quoted with the "a'" sounded "ay;" and the word "pages" in a theatre bill pronounced "paggies."

MR. EDISON has lately advanced the opinion that fatal accidents from electric currents would continue to increase with the multiplication of over-house wires, carrying powerful currents, till some dreadful accident occurred to arouse public indignation and compel the placing of all such wires underground. In cases of fire, particularly, the breaking of a great number of wires, which would be thrown down in inextricable confusion by the falling of a roof, might have serious results. Mr. Park Benjamin, a well-known scientific man, has called attention in New York to the fact that a stream of water from a hose nozzle, striking a broken arc-light wire, might easily serve to conduct the current through the body of the fireman who held the hose, with fatal consequences; while the cutting of such a wire with an axe, particularly if the handle of the axe were wet, might have a like effect. One of our scientific contemporaries, presumably from sheer ignorance of the dangers which must attend the transmission of strong currents through over-house wires, and of the fatalities already recorded, absurdly adds, that "if one fireman were to hit another hard over the head with an axe, whether the handle was wet or dry, the man hit would receive a violent shock. Mr. Park Benjamin has curiously enough omitted to call attention to this fact. It would, perhaps, be better, under the circumstances, either to give up the use of electricity, or else to have no more conflagrations. By either expedient comparative safety would be secured for fire brigades." This may be meant for wit, but we fail to see it. The danger is a real one, and in justice to the public themselves we are constrained to again re-echo the warning.

THE fishing in Sir Joseph Hooker's park at Kew is also good—so his friends say. His enemies, and some who are neither one nor the other, speak in a different way about both the fishing and the shooting. They say it may be abundant, but it is not altogether the right thing.

THE Garden—we beg his pardon, Sir Joseph's estate—is positively open now to the public for no less than *two hours and a quarter* on Sundays, on week-days for three hours and a quarter.

THE gate which was to be blocked up is now only lumbered up, and seems likely so to remain.

THE *North Times* has suddenly become an ardent (an amazingly ardent) advocate of the most uncompromising school of vivisectionists. After quoting our remark that most of us cannot tolerate the thought of vivisectional experiments "on even the most worthless of human beings," the *North Times* remarks that it makes the blood run cold to read these lines, that they are entirely unchristian and irreligious, nay, "constructive blasphemies and appalling outrages on the very name of our common humanity." We are sorry for it; but at the risk of still further hurting our contemporary's feelings, we must repeat that to us, and we believe to most men, the very thought of experiment on human beings, however worthless they may be, and however valuable or dear the lives in whose interests such experiments might be made, is utterly intolerable. We cannot see why this should be considered a "constructive blasphemy" (not that we have the least idea what a constructive blasphemy may be). There may be some recondite reference to the sacrifice of life for life in Christian annals; but, apart from some such reference (if there is any), we find our contemporary's indignation inexplicable, astounding, almost staggering. Anything more barefaced than this advocacy of the most pronounced views of vivisectionists we have never heard of, and could hardly have believed credible in a civilised community!

AT a recent meeting of the Buda-Pesth Society of Natural Science, Professor Than (a member of the committee appointed to investigate theatre fires) spoke on the danger of ordinary gas, and the means of reducing it.

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From experiments, he was of opinion that gas was not dangerous so long as it occupies less than 5 per cent. of a given space; between 5 and 12 per cent. it begins to be ignitable, and at 29 per cent. the danger of explosion is present in high degree. He has improved Anselm's apparatus (which, acting on the principle of diffusion, causes an electric bell to ring as soon as a certain quantity of gas is present), so that even $\frac{1}{2}$ per cent. of escaped gas causes loud ringing. Another ingenious arrangement shows the actual percentage quantity of escaped gas, while a control-manometer, which Professor Than has used several years in his laboratory, reveals the place of escape of the gas.

THE *Railroad Gazette* record of American train accidents for August shows for that month a total of 139 accidents, by which 46 persons were killed and 218 injured. There were 65 collisions, in which 27 persons were killed and 117 injured; 70 derailments, with 18 persons killed and 100 injured, and four other accidents, in which one person was killed and one injured. Twenty-six accidents caused the death of one or more persons each; 28 caused injury, but not death; while in 85, or 61·2 per cent. of the whole number, no serious injury to persons is recorded. These accidents may be classed as to their nature and causes as follows:—Collisions: Rear collisions, 41; butting collisions, 20; crossing collisions, 4; total, 65. Derailments: Broken rail, 2; broken switch road, 1; broken bridge, 4; spreading of rails, 7; broken axle, 4; broken wheel, 2; broken truck, 1; wash-out, 5; accidental obstruction, 4; cattle on track, 8; misplaced switch, 7; neglect to use signals, 1; purposely misplaced switch, 2; malicious obstruction, 1; unexplained, 21; total, 70. Boiler explosion, 1; broken connecting-rod, 1; broken crank-pin, 1; broken axle, not causing derailment, 1; total, 139. Derailments of the long American cars are thus the most frequent form of accident.

A NEW use has been discovered for potatoes. They can be converted into a substance resembling celluloid by peeling them, and after soaking in water impregnated with eight parts of sulphuric acid, drying and pressing between sheets of blotting paper. In France pipes are made of this substance, scarcely distinguishable from meerschaum. By subjecting the mass to great pressure, billiard balls can be made of it rivalling ivory in hardness.

WE propose in the next two weeks to give a very much simpler account of Venus's transits than in the comparatively difficult papers now nearly completed.

SEVERAL physicists, chemists, spectroscopists, and others who chance to be not also mathematicians or astronomers, have recently advanced, advocated, or adopted the theory of an interstellar and interplanetary atmosphere, to which —being free from the restraints imposed by a knowledge of astronomical and mathematical laws — they assign various degrees of rarity, according to the requirements of their own or their friends' pet theories. Astronomers have looked on with some amusement at the innocence with which enormous volumes of carbonic acid gas, the vapour of water, nitrogen, oxygen, hydrogen, and so forth, have been added to the interstellar universe, in calm unconsciousness that if science is to accept these additions, all that Galileo, Kepler, and Newton have taught (and which we had supposed proved) must be abandoned. While enjoying the joke, astronomers have not been very anxious to advance the overwhelming arguments which have always been available. But as these invaders of the domain of the exact science have lately seemed to mistake this reticence for acquiescence, it seems desirable to show at least the *shape* of the rock-masses which overhang the precipitous and trackless region over which they have been for some time cheerfully adventuring. For this reason we give this week M. Faye's masterly though short demolition of these theories, which we would recommend in a special manner to the attention of Dr. Siemens, Mr. W. M. Williams, the Editor of *Nature*, and others, who appear to regard mathematics as the bane of science, because it kills wild theories.

EIGHT full columns of Mr. Murray's publications appeared in the *Standard* of the 14th inst.

AMONG the many unexpected developments of electrical science is an application in the hiving of bees when they swarm, successfully tried by German experimenters. It was thought that by utilising the electric force the bees might be stupefied for the necessary period of time without being injured, and the result proved the correctness of the idea. The first attempt was made upon bees that had gathered upon trees, the insects falling upon the ground in a kind of trance, which admitted of their being safely handled. The next stage in the experiment was to capture the bees when they were about to swarm. By introducing the ends of two connecting wires into a fully-occupied honeycomb and turning on the current, the bees were rendered inactive for about thirty minutes, while no bad results appeared to follow their awakening.

FROM Sydney is reported the discovery of a new building material at Suva, on one of the Fiji Islands. It is known as fossil coral, and when cut from a mass is soft, but on exposure to the air it looks and is very much like brick. During the short time it has been known it has satisfactorily stood the tests that have been applied to it. Orders have already been received for quantities of it to be used in building.

IT is a remarkable fact that there are no rats in the islands of the Pacific Ocean. Repeated attempts have been made to acclimatise the rodents there, as the flesh is much esteemed by the natives as an article of food. But the attempts thus far have failed, as they [the rats] invariably die of consumption.

IN the hour columns on p. 373 relating to the comet's path, there are some obvious mistakes, relating, however, only to the part of the motion still to be observed. Thus in the first table the *hours* on Nov. 25, 29, and Dec. 2, should be 2, not 3, while those in the second table, for Nov. 21, 25, 29, and Dec. 2, should be 4, not 3. Circumstances caused our time for correcting those columns to be very short indeed.

NEXT week we shall give some pictures of the comet, and our promised discussion of the probable effect of its destruction by the sun.

WITH No. 61 the Exchange and Sale Advertisement Columns will be discontinued, as we find we frequently have to defer them for want of space.

M. FAYE ON INTERPLANETARY AIR.

FEW features in recent scientific developments have a more unwholesome aspect than the reticence with which false doctrines are received by those who *know* them false—if advanced by men who have (deservedly, perhaps) attained a high position in science. It seems to be regarded as a point of courtesy to avoid all reference to obvious flaws in reasoning, and to speak only of the possibly correct experiments, well-observed facts, and charming results *if* the theory were true, leaving altogether out of sight the clear and certain disproof (often multitudinous disprocfs) which yet those who thus use flattering words have perfectly recognised from the beginning. I would cite as among the worst illustrations of this weak and unmanly way of dealing with science, the tone in which men who ridiculed among themselves Professor Tait's Sea-bird Theory of Comets' Tails, spoke in public as if it were an admissible and possible theory; the silence of those who *knew* about the flaws in Professor Tyndall's Negative Shadow theory of the same phenomena (as if Professor Tyndall, of all men, were such a weakling as to need the unclean sacrifice of untruth, which some seem to love); the reticence of many respecting Professor Sir W. Thomson's meteoric theory of the origin of life on the earth; and the way in which men who are known to have expressed privately their recognition of its fallacy, have publicly written and spoken of Dr. Siemens's theory of solar energy. To my mind, apart from all worthier reasons for objecting to this lip-serving humbug, better suited to Oriental courtiers than to men, it is a very poor compliment to whose whom it is meant to please—it implies that they care more for flattery than for truth, that they are too foolish to see through all this, or fail to perceive the "claw me and I'll claw thee" tone which runs through it all.

We hail then, cheerfully, the sensible and manly, yet (in the best sense) courteous tone in which M. Faye, the eminent French astronomer, has discussed Dr. Siemens's new theory of the sun, giving one among the many complete and convincing disproofs of which the theory, being essentially wrong, necessarily admits. M. Faye is not wanting—no man of sense can be—in just appreciation of Dr. Siemens's eminent services to science, but when Dr. Siemens talks paradox, M. Faye does not hesitate (no honest man of science should hesitate) to say plainly that it is so.

"We know," he says, "that under the action of light, and with the intervention of chlorophyll in plants, the vapour of water and carbonic acid gas are decomposed at ordinary temperatures, and restored to combustible forms, carbon and hydrogen variously associated. Dr. Siemens, an English man of science, has inquired whether the action of the sun alone might not effect this decomposition, when we subject to it the vapour of water and carbonic acid gas greatly rarefied—reduced, for instance, to one 1,800th of atmospheric pressure. These experiments, which only need, in my opinion, a counter-test, easily applied, would seem to have given affirmative results. Thus, gases which had undergone combustion, having been so rarefied that the induction spark would no longer pass through them, a few hours' exposure to solar light sufficed to cause the mixture to let the induction spark pass with the well-known colouring which it takes in hydrocarbonised media.

"Regarding these five experiments as decisive, Dr. Siemens has been led to ask whether the phenomenon might not play a more important part in the universe than in vegetable life. Regarding space as filled with analogous gases which had already undergone combustion, the light of the sun would revivify the combustibles, hydrogen and carbon, which would then be ready to furnish fuel for fresh combustion.

"In drawing them back to himself and burning them afresh, the sun would recover a large part of the enormous heat, the radiation and loss of which in celestial space we are so pained to see.

"Dr. Siemens has thus been led to enunciate the following hypothesis:—Space is filled with burned gases" (gases the products of combustion, *gaz brûlés*)—the vapour of water, and carbonic acid gas, mixed with inert gases, nitrogen, &c., somewhat like those of our own atmosphere at 1-2000th pressure. These gases would be partially transformed into combustibles under the action of solar light; then, by a mechanism similar to the air-sucker of a pair of bellows, the sun would draw them back to him, burn them, and send them back into space. This immense source of heat would thus continually revivify itself; the only part of its radiation lost would be that which would not be absorbed by the cosmic medium 1-2000th in density [which, unfortunately for the theory, is nearly all that had troubled us,—the stars being our witnesses.—ED.].

"It is true enough that air at 1-2000th pressure would be to the physicist an almost absolute vacuum; so that, in such a vacuum, the electric spark would not pass. But for the astronomer, such a medium would be quite dense (*bien grossier*). When we speak in astronomy of the resistance of a medium on the æther, and with the help of most delicate observations and most profound calculations, seek the traces of this resistance, *we have something very different in view* (*il s'agit de tout autre chose*).

"Without entering into details, I note that the trajectory of a cannon-ball, travelling 500^{m} (547 yards) per second is altered at the end of even only a few seconds, in such sort that astronomers are forced to take into account the resistance of the air in their range-tables.

"Reducing the air to 1-2000th, but raising the velocity of the projectile to that of the celestial motions, 60 times greater, for instance, these coarsely obvious results would, for a host of heavenly bodies of dimensions comparable to our cannon-balls (as bolides, flights of shooting-stars, aerolites), be twice as great as in our practice ranges, not at the end of several years or several centuries, but at the end of a few seconds.*

"Secondly, it appears to me that the eminent English physicist has to some degree omitted to consider the quantity of matter he was about to add to the solar system. Under the effect of attraction, this matter would unite itself to pre-existing stars, the sun in particular, and would continually augment their mass.

M. Faye goes on to consider the mass which would thus be added to the sun, considering only such parts of the interstellar atmosphere as lie within Neptune's distance from the sun. He finds this sphere of interstellar air, even of the tenuity indicated by Dr. Siemens, would amount to about 100,000 times the present mass of the sun—a trifling addition of which astronomers might expect to find some traces in the celestial mechanism. This consideration forces us to reject absolutely and decisively an atmosphere such as Dr. Siemens and Mr. W. M. Williams have imagined—whatever opinion we form as to the existence

* There would even, in the resistance of such a medium, be a source of additional heat for the terrestrial globe, quite independent of the sun. Judging from certain experiments by Sir William Thomson on the elevation of temperature of a thermometer moving in air with a certain velocity, that of the terrestrial globe due to resistance against this medium would be several hundreds of degrees (centigrade).

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or non-existence of limits to planetary and stellar atmosphere.

"It is little likely," proceeds M. Faye, "that astronomers will accept such hypotheses. Doubtless they would be well pleased to think that nature has in reserve for the sun a resource by which his heat may be made to last longer; but as his final cooling is, in any case, a catastrophe still very far off, they will be consoled by the thought that none among the things of this world—not even the noblest—seem made to last for ever.

"As for the fundamental experiments of Dr. Siemens, these will lose none of their importance in the eyes of astronomers. It is a question of a conquest of one of the secrets of living nature, one of the laws of the organic world: they will earnestly desire (*ils feront des vœux*) that Dr. Siemens should pursue the path so brilliantly entered on, though they cannot expect from it any very brilliant light for their own department of research."—*From M. Faye's Address before the Paris Academy of Science.*

EARTHQUAKES IN THE BRITISH ISLES.—III.

(*Continued from page* 374.)

IN the year 1784, Loch Tay was disturbed in a very remarkable manner. The water receded from the two ends and rose in a great wave in the middle of the lake-basin; then this wave spread itself laterally over the shores, passing high above the usual limits of the lake. This was repeated every day for a week, with less and less violence. It is worthy of notice that the year 1784 was remarkable for the earthquakes which disturbed different parts of the world. One occurred on the 18th of July, in Armenia, and caused the loss of upwards of six thousand lives. The city of Ezerghan was destroyed by the same shock. But the volcanic effects observed in Iceland in the same year were yet more remarkable. In fact, Iceland had been disturbed more violently during that and the preceding year than at any former period in the history of the island. "It has been calculated," says Professor Ansted, "that a single volcano in the wild and untrodden desert lying in the south-east part of Iceland threw out that year fifty to sixty millions of cubic yards of matter. The accounts which have been handed down to us of this event present to us a picture almost too terrible for belief. With a widespread destruction of the land, the depths of the sea were invaded, and the fish (the Icelanders' chief means of subsistence) driven from the shore. The flames broke out even through the waves in the line of movement, and the sea was covered with pumice for 150 miles. A thick canopy hung over the island for a year, and the winds carried the ashes over Europe, Africa, and America. The very sun was darkened, and showed only as a ball of fire; while frightful hurricanes, hailstorms, thunder, and lightning added their horrors."

It is also well worthy of notice that the great earthquake of Calabria had taken place but a year before, and that while this great convulsion of nature lasted, the barometer in Scotland sank within a tenth of an inch of the bottom of the scale, and the waters of many of the Highland lakes were much agitated.

Late in the year 1789 a singular incident took place near Comrie. The ice on a lake there was suddenly shivered into atoms. There had been a tremendous earthquake on the 30th of September at Borgo di San Sepolchro, in Italy, during the course of which many buildings were wholly swallowed up. And, lest we should seem fanciful in associating this earthquake with events which happened in Scotland, we extract the following passage from the *Scots' Magazine*, referring to the Italian earthquake. It says: "On the same day three distinct shocks of earthquake were felt at the house of Parson's Green, on the north side of the hill of Arthur's Seat, near Edinburgh." Only four days before the county of Wiltshire had been shaken by a very perceptible shock of earthquake.

A somewhat severe earthquake was felt in Edinburgh in the year 1801. Singularly enough, the shock was not felt in the Old Town. But in the New Town the sensation experienced was as though the houses had been lifted bodily upwards, and then violently shaken from north to south. Some hours afterwards a house sank so much that the magistrates condemned it. The gable of a barn near the city fell in upon some reapers and crushed two of them to death. We believe this is the only earthquake which has taken place for many centuries in the British Isles in which there has been any loss of life. At Crieff and Comrie the earthquake was felt even more distinctly than at Edinburgh; but no buildings were injured.

But perhaps the most remarkable earthquake experienced in the British Isles during the present century is that which took place on the evening of August 13, 1816. The summer had been remarkable for heavy storms of rain and hail, which caused much mischief to the crops; and a circumstance which had attracted much attention was the want of correspondence between the barometrical indications and the weather, the barometer often rising before heavy storms and falling before fair weather. The earthquake of August 13 was felt over nearly the whole of Scotland. But its action at Inverness was much more intense than at any other place. Indeed, one is reminded of the narratives of more destructive earthquakes by the account of the scene presented in Inverness on the night of the occurrence. Most of the inhabitants had gone to bed, when suddenly a violent vertical shock was experienced, followed immediately by a trembling which lasted for about half-a-minute—or longer as some thought. So violent was this earth-throe that many were flung out of bed. "All others who had gone to rest," says the narrative of the event, "instantly sprang from their place of repose, and with little ceremony as to clothing, joined the crowds who had rushed into the streets, which immediately became a scene of wild and unusual terror, no one knowing but what a second shock was immediately to bury them under the ruins of their houses. Under this apprehension many hurried, ill-prepared as they were, out of the town, and spent the greater part of the night in the fields. It was found that already great damage had been done to the buildings. Many were rent from top to bottom; great numbers of chimney-tops had been shaken down. From a stack of chimneys on the Mason Lodge, a coping-stone weighing fifty or sixty pounds was thrown to the other side of the street, a distance of not less than twenty yards." Nothing could more strikingly exhibit the energy of the lateral vibration than the fall of this great stone. It is wonderful that much more serious damage was not effected by a shock of this nature.

It was noticed that the old buildings suffered less than the new during this shock. Three gentlemen who were approaching the town from the westward heard the great bell toll twice, but the townspeople, amid the crash of falling stones and tiles, and the shrieks of terrified women, did not notice the sound.

When the morning came it was observed that a steeple which had recently been fixed to the county gaol had received a twist a few feet from the top. The spire was

octagonal in shape, and was twisted through about a sixteenth of a circumference, from the east towards the north. For upwards of ten years the steeple exhibited this curious token of the energy of the earthquake of 1816, but it was afterwards repaired.

In other parts of Scotland very remarkable effects were experienced during the occurrence of this earthquake. Three arches built across an arm of the sea in Sutherland were flung down. A man who was walking amongst the mountains of Lochindorb "was first alarmed by a sudden and tremendous noise of a rushing wind, which came sweeping up the hills like a roar of water; this was instantly followed by a rumbling noise, and the ground was sensibly heaved up and down under his feet." A similar noise and motion were observed near Montrose by two excise officers who were on the watch for smugglers. They were lying down on the ground when the shock came, and one of them leaping up exclaimed, "There they are! I feel the ground shaking under their horses' feet!"

It is worthy of notice that only six days before this remarkable earthquake Mount Vesuvius had been in eruption.

HAIR EELS.

By Dr. Andrew Wilson, F.R.S.E., F.L.S., &c.

SOME time ago a correspondent of Knowledge wrote to the Editor that a large number of "hair eels" had appeared in the ponds and ditches in his neighbourhood. He remarked, in the course of his letter, that he "noticed one hair eel struggling with a black-beetle (probably a water-beetle), which was floating on the surface of the water. In a short time the hair eel, which was quite white, had freed itself, and sank to the bottom immediately. Seeing the two 'insects' struggling together, recalled to my mind that I had somewhere read of these eels being internal parasites of black-beetles and grasshoppers. It would be interesting," adds the writer of the letter, "to know if this is really the case, and if not, where the eels come from, and what becomes of them on the approach of winter." As there are doubtless many readers of Knowledge who feel curious concerning the biography of the hair eels, I will endeavour to state the few plain zoological facts in which their history may be said to be comprised.

The zoological position of the "hair eels" is perfectly well ascertained. They are, in a sense, "worms"; removed, no doubt, from the area of the ordinary earth worms, sea worms, and the like, but still related by many ties of kinship to these familiar forms. There is a group of "worms" known to naturalists as *Nematelmia*, a name literally meaning "round-bodied worms." In this group the hair eels find a home, and their rounded form separates them from the tapeworms and flukes, which are denominated "flat worms" (*Platyelmia*). Included in the round-bodied section, we find such worms as the common internal parasites of man and other animals. Such are the "thread worms" (*Oxyuris*), the "common round worms" (*Ascaris*), the *Trichina* found in diseased pork, the guinea worm, and allied species. All of these forms differ from the ordinary worms in possessing no well-marked ringing or segmentation of their bodies. Very rarely do we find in them the side-bristles and appendages we see so familiarly in the sea-worms, and also, but somewhat modified, in the earth-worms and their neighbours. Again, most of the "round worms," like most of the "flat worms," are parasitic, either during the whole of their lives (*e.g.* tapeworms, flukes, thread-worms), or during a part of their existence. Under this latter category, the hair eels may be ranked, as we shall presently observe.

The "hair eels" are technically named *Gordiacea*, and the *Gordius aquaticus* is the scientific name of the common species. The well known vinegar eels, which make their appearance in vinegar, in decomposing paste, and in like fluids, resemble them in form, but, of course, differ materially in size. There are several curious points connected with the anatomy and habits of the "hair eels," which, by the way, should be properly named "hair worms," of course. Thus, in the first place, their digestive system is of imperfect nature, and no posterior aperture exists to this system, which, in fact, opens into the cavity of the body. This disposition of the intestine is not unknown in other groups of the animal series, and its occurrence would seem to indicate that the functions of the digestive apparatus are in some respects differently carried out from those of normal forms. Then, secondly, there exists in the hair worms only an imperfectly-developed system of "water-vessels," such as we find well developed in allied worms. The use of these vessels is still problematical, but their presence is highly characteristic of both round and flat "worms."

In respect of their habits, however, the hair worms are peculiar. That part of the correspondent's letter in which he speaks of the hair worm struggling with the insect, becomes highly interesting, inasmuch as it supplies a clue to the real history of these curious animals. One of their chief characteristics is that they inhabit the bodies of insects during at least part of their existence. They are thus partially "parasitic" in their habits. The life-history of a hair worm, in fact, begins with its appearance when liberated from the egg (produced by the parent form), as a minute speck, swimming freely in fresh water. This youthful worm is provided with a boring apparatus, in the form of a kind of proboscis armed with hooklets. In this respect it reminds us of the young tapeworm itself, which is provided with a crown of hooks adapted for boring. Thus armed, the young hair eel seeks an insect host, and boring its way into the insect tissues, there ensconces itself. Development now proceeds so far, that within the insect's body we find a hair worm which may far exceed its host in length. Sooner or later development is completed, and the adult stage reached by the appearance of the egg-producing or reproductive organs. The sexes in the hair eels are situated in different individuals. When the period of egg-deposition arrives, the worm seeks to leave the insect-body which has sheltered it. It was at this stage of the hair eel's career that our correspondent beheld the worm; and, passing from the insect's body, the liberated hair worm once again finds itself in the water. Here the work of laying the eggs proceeds apace. The eggs appear to be deposited in long strings in the water, and after the process of development has proceeded sufficiently far, we behold the young embryos, with their boring apparatus, ready to repeat the parental history. The swarms of hair eels which appear in our ponds and brooks in summer are the newly-liberated worms about to begin the work of egg-laying.

Such being the well-ascertained history of the "hair eels," we can readily value at its true worth the superstition, not yet extinct, which maintains that they arise from horse's hairs, which by some marvellous process of vivification assume the likeness of the worms. Over and over again, in newspapers and elsewhere, have I had to combat this absurd belief. Frequently, persons who should have known better have assured me that they have placed horse's hairs in a stream, and in a few days or hours have seen hair worms swarm therein. Such ingenuous minds do not see the *post hoc ergo propter hoc* fallacy in which they indulge.

Because they put hairs into a brook, and because there afterwards appear hair worms, therefore the hairs have begotten the worms—such, of course, is the argument. But only a worse than childish intellect will receive this reasoning as good or likely. I have never yet had my demand for an experiment with some horse's hairs and a bowl of water at home satisfied; and I need hardly remark how fatal is the facility with which the difficulties of proving that the hairs placed in a stream actually became the living worms are glossed over. The persistence of this superstition exhibits anew that belief in the marvellous which is often uninfluenced by exact science.

Laying aside this startling theory of spontaneous generation as childish folly, we may note that near relations of the hair worms are known to exist in latitudes far removed from the familiar ponds and ditches around us. A species of hair worm is known to live beneath the shells of shrimps at enormous depths in the sea. One might feel tempted to ask if this hair worm is also generated from equine appendages; for what holds true of the *Gordius* of the pond, should logically apply, of course, to all its kith and kin. Another member of the hair worm's family circle is the *Mermis*, which is found coiled up inside the bodies of butterflies and moths. Like the hair worm, *Mermis* escapes from its insect host at the time of egg-deposition, and buries itself in the soil. The young *Mermis*, armed with a boring lancet, pierces the soft bodies of caterpillars, and grows to maturity, in fact, along with the insect, as the latter becomes the chrysalis and perfect insect respectively. There is also another ally of the hair worm, which lives as a lodger and boarder in the interior of that friend of the flowers, the humble bee. This is the *Sphærularia*, with whose history Sir John Lubbock and Mr. Cole have made us acquainted. John Hunter knew *Sphærularia* well, but in 1836 it was more fully examined by Dufour. The female worm, or that which is found in the bee, is about an inch long. It is white, and possesses a body bluntly pointed at either end. It is covered by small warty projections. No mouth or digestive system exists, but a very large "fat body" occupies the interior of the parasite. The male *Sphærularia* appears to be about 28,000 times smaller than the female. In this curious group of animals the habit of leaving the insect host to propagate the species is probably represented as in the hair worms themselves. As a final remark concerning the hair worms, I may refer to the well-known fact of their remarkable tenacity of life. Both young and adult hair worms can be dried and mummified, and kept in this dessicated state for lengthened periods; yet upon the addition of moisture they at once revive, and appear able to resume all the functions of life as before. Similar phenomena occur in the history of the *Rotifera*, or "wheel animalcules." In what state the animals actually remain, or on what this "potential vitality," as it is called, depends, we do not know, but their tenacity of life may well explain how their existence is perpetuated through the winter's cold and under conditions of more rigorous nature still.

Is it True?—An American paper says:—"There was excitement in front of the Central Methodist Church, Market-street, Newark, N.J., on Saturday evening last. Adjoining the church is a building with iron columns, which is supplied with electric light, and somewhere in the circuit a telegraph wire had fallen upon the electric wire, thus charging the building near the church. The current extended to the iron fence outside, and four persons who had touched the fence in passing had been knocked down. They were not seriously injured."

THE TYPE-WRITER.

By Richard A. Proctor.

SEEING an advertisement of this instrument in the columns of Knowledge, I thought it would probably be the very thing for me—if I could get over the habit of associating mental work with the manipulation of a pen. I remembered that when Goldsmith tried dictating instead of writing, he failed—only when urging pen over paper could he express his ideas with his wonted freedom. I had had a somewhat similar experience myself. A day or two before I gave my first lectures in New York, four stenographers from the office of the *New York Tribune* called on me by appointment, to take down the first lecture from my own lips. I tried to imagine an audience, and to talk as if addressing one. But it was useless. After some ten or twelve sentences, I told the four reporters I could make nothing of it; I could *not* lecture without an audience. The case of the aspirant to oratorical fame and the cabbages was reversed: he practised before a set of cabbages, and could only tell a real audience that "he—he—he perceived they were not cabbages;" I had never lectured save before an audience and trusting to the inspiration of the moment to give me fit words for what I had to tell them; and, though the four reporters were very far indeed from being cabbages (on the contrary, four as bright and clever men as one would care to meet), I had to tell them I perceived they—they—they were not an audience.

It was with some doubt, therefore, that I began to try the Remington Type Writer, especially as the makers consider that some time should be given to practice before using the instrument for regular work.

I was agreeably disappointed. In a few minutes one begins to know where the letters are, and not long after one begins to find the way of knocking off the short words —*the*, *and*, *was*, *that*, *in*, *if*, *of*, *there*, *ever*, *were*, and so forth, almost at a stroke. The mind forms ideas and sentences as readily as with the pen; and though at first the rate of writing is, of course, slower than with the pen, the work is much pleasanter.

In my own case there was no time wasted over practice. I gave up a certain department of my work with Knowledge (the "Answers to Correspondents," if you *must* know, Mr. Inquisitive,) to the type-writer; and so made progress at once with practice and with my work. I only found one defect in this arrangement. It was so much pleasanter to work with the Writer than with the pen, that I was disposed to give more than due time to the Answers.* Fortunately, correspondents are so numerous, and increase so fast, that material was not wanting. To the accompaniment of our "Steinway," on which divers members of my family continued *their* practice, the work went merrily forward, and that which some readers regard as sulphuric acid, while others only just recognise in it an occasional (and then slight) acidulous flavour, trickled over the paper from the almost noiseless writer.

The use of the instrument, pleasant from the beginning, grows pleasanter with every day's practice, until there is quite a charm in manipulating these little keys. The rate

* In passing, I may note that many readers seem not to understand that the greater the space given to Answers, the more space is saved for the large-type matter which the bulk of our readers chiefly care for. Almost every answer means a letter which would otherwise have appeared in the "Correspondence," to elicit, perhaps, a dozen answers, and possibly a lengthy controversy. Putting an average of only one column for each (which is very moderate), I find that about twenty pages weekly would be required for correspondence. Thus, I am absolutely forced to adopt some such plan of dealing with most of the letters which reach me.

of writing, of course, increases with practice, and as I am a mere beginner, having only bought my instrument a few weeks back, I am as yet unable to say what rate can be obtained with it. I have not yet learned to write with it as fast as with the pen—perhaps I may never be able to do so. For I am an unusually rapid writer. Mr. J. G. Petrie, in a very interesting paper on "Reporting and Transcribing Machines" (published by Jas. Wade, London, price 6d.) says the maximum rate of writing is from thirty to forty words per minute, but that few writers can keep up that rate of writing for many minutes, and the writing would then be far from legible. I find, however, I can, at a pinch, write from forty to fifty words a minute, and keep up a rate of from thirty to forty for quite a considerable time, and as I get very clean proofs, I infer that compositors can read my writing. That does not prove my writing legible in the ordinary sense, for compositors can read almost anything.

The following sentences quoted from the above-named pamphlet were written at the rate of forty-seven words a minute (sub-editor's timing). I will faithfully record, later, how many mistakes the rather villanous writing has caused the much-tried compositor to make. [I hope the most skilful will be selected.]

"Like everything else in this world, there is a right way and a wrong way of manipulating the machine. The keyboard is composed of forty-four keys, arranged in four rows, and these would be almost equally divided between the fingers of both hands; the right hand manipulating the right half of the keyboard, while the left hand works the corresponding half. By using the three first fingers of each hand, as I have said, a good style of playing the machine can be acquired; and in order to gain facility for its working, those words which are most in use in the language, amounting to a few hundreds, and which can be taken out of any shorthand instruction book, should be practised over and over again until ease and facility in writing them are acquired. The long bar, which makes the spaces between the words, is always struck by the third finger of the right hand, and in course of practice this action becomes quite automatic."*

To the last point in the above passage I venture to demur. I find the bar much more conveniently struck with the thumb of either hand. From the beginning, the Space, which I had thought likely to be often omitted, was readily and systematically marked, except when the rate of work was pushed beyond that which practice had rendered easy.

It is claimed that with great practice fifty or sixty words a minute can be printed with the "Writer," and some thirty a minute, neatly and clearly printed, would be better work than forty scrawled, and save much time, too, in the long run. Then the work is so much pleasanter. One can sit squarely up to the instrument, and take a good full breath at each inspiration, instead of filling the merest corner of the lungs, as when busily engaged in writing—especially when trying to write very quickly.

RUSSIA AND THE TELEPHONE.—We do not hear much of any progress being made with the telephone in the Russian Empire. A facetious contemporary explains this circumstance by the fact—if it is a fact—that the exclamatory halloo! with which, as everybody knows, all telephonic conversation must begin, is, in the Russian language, rendered Tzijakanfitkrajanjanzski! which, of course, no telephone yet invented can pronounce.

* Total number of errors in author's first proof—0.—R. A. P.

THE AMATEUR ELECTRICIAN.

ELECTRICAL MEASUREMENT.—V.

THE question which next presents itself is, having a certain number of cells, and a certain line-resistance to be overcome, what will be the most advantageous mode of joining the cells together so as to get the greatest possible amount of work out of them? By taking an example we shall see that the best result is obtained when the two resistances, internal and external, are nearest to equality. Suppose we have 40 ordinary Daniell cells, each having an E M F (electro-motive force) of one Volt, and each offering a resistance of 10 Ohms to work a circuit of 100 Ohms resistance. When joined up in series we get

$$\frac{E}{R+R'}=\frac{40}{400+100}=\cdot08$$

If we divide the battery into two series of 20 cells each, and then put them side by side for quantity (see Fig. 1, KNOWLEDGE, No. 51) we get

$$\frac{E}{R+R'}=\frac{20}{100+100}=\cdot1\cdot1$$

The E M F becomes 20 Volts, because there are only 20 cells in series. With a single set of 20 cells the value of R (internal resistance) would be 200 Ohms, but as we practically double the size of the cells by joining a similar set of 20 cells with it for "quantity," that value is reduced to 100 Ohms; so that whereas 40 cells in series give 400 Ohms, the same number joined up as just described give only 100 Ohms.

If now we divide the full battery into four sets of 10 cells each and join all these sets side by side, we get

$$\frac{E}{R+R'}=\frac{10}{25+100}=\cdot04$$

In this instance R becomes 25, instead of 100, because instead of one battery there are four batteries side by side, quadrupling the conductivity or quartering the resistance. It is here clearly demonstrated that, while in the first case the battery resistance exceeded the line resistance, and in the third case *vice versâ*; in the second instance the two resistances were exactly equal, and as was predicated, the greatest strength of current was then obtained. This is well worthy of thoughtful study, not so much, perhaps, for working out problems, as for firmly imprinting upon the mind the very important deduction laid down.

In deciding on the form of battery to be used for any particular kind of work, resort should always be made to the simple formula we have been explaining. It frequently happens, however, that we cannot obtain a current of given value in Volts and Ampères without having a greater or less difference between the internal and external resistances. Let us suppose, for instance, that we want to illuminate a small room with an incandescent lamp which offers a resistance of 30 Ohms, and absorbs a current of 1·2 Ampères, with an E M F of 40 Volts. Suppose we tried it with 40 Daniell cells, we should get

$$\frac{40}{400+30}=\cdot093,$$

which is a long way short of what we require. In fact, in order to procure the required current it would be necessary to place 100 sets of 40 cells each, side by side, in order to reduce R to the value most useful for our purpose. Let us next try a Bunsen battery, each cell having an E M F of 2 Volts; 20 cells joined together in succession or series will give us 40 Volts. The internal resistance is very low, 20 cells giving 3 Ohms, or ·15 per cell. We therefore get

$$\frac{E}{R+R'}=\frac{40}{3+30}=1\cdot2$$

There is here a considerable difference between the internal

and external resistances, but this is unavoidable in order to satisfy the requirements of the lamp. We can only reduce the external resistance by joining a number of lamps in parallel circuit or multiple arc. This consists in joining two or more lamps together in such a way that the current coming from the battery or generator on reaching

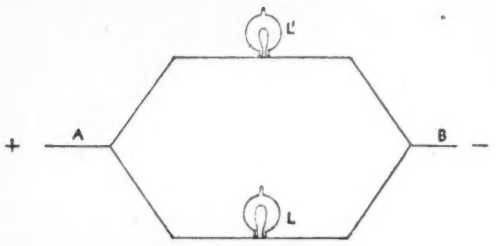


Fig. 1.

the junction, A, Fig. 1, of the lamps L, L' will divide between them, the two currents reuniting on emerging at B. It will be apparent on a little reflection that looking at a lamp as a conductor, two lamps put side by side or in parallel circuit, double the conductivity of a circuit having only one lamp, or, in other words, halve the resistance. The equations then become

with 2 lamps $\frac{40}{3+15}=2\cdot\dot{2}=1.1\dot{1}$ per lamp

with 5 lamps $\frac{40}{3+6}=4\cdot\dot{4}=\cdot88$ per lamp

with 10 lamps $\frac{40}{3+3}=6\cdot\dot{6}=\cdot6\dot{6}$ per lamp

In explanation it may be pointed out that although the joint resistance of the external circuit in, say the first case, is only 15 Ohms, each lamp offers a resistance of 30 Ohms. In the same way a water-pipe offers the same individual resistance to a flow of water, when another similar pipe is placed side by side with it to increase the delivery. The pressure of water, or the E M F of the electric current, are not affected by a reduction in the respective resistances, and consequently the E M F will be the same through each lamp, but as the current will have a choice of two similar channels or circuits, the *amount* of current will be equally divided between them, so that we get only $1\cdot\dot{1}$ Ampère instead of 1·2. This may be thought to be only a slight difference, but we shall recognise its importance if we bear in mind that we lose that part of the current which is most effective in illuminating the lamp. This loss of luminosity continues as we add the lamps, until heat only is generated.

To secure sufficient current to furnish a strength of 1·2 Ampères per lamp, we must increase our battery power, adding similar sets by the "quantity" arrangement, so that

with 2 lamps, 2 sets will give $\frac{40}{1\cdot5+15}=2\cdot4\dot{2}=1\cdot2\dot{1}$ per lamp.

with 5 lamps, 5 sets will give $\frac{40}{6+6}=6\cdot0\dot{6}=1\cdot212$ per lamp.

with 10 lamps, 9 sets will give $\frac{40}{\cdot3+3}=12\cdot0=1\cdot2$ per lamp.

The slight excess of current in the two first instances is increased in the third instance to sufficient to enable us to use nine sets instead of ten with which number we should get $1\cdot2\dot{1}$ per lamp.

In each of the cases above cited the E M F was the same, but it must not be forgotten that when we join the lamps in series so that the whole current passes through each lamp, then we must increase the E M F in proportion. For instance, if we wished to illuminate two lamps in this way, we should require 40 cells, when we should get $\frac{80}{6+60}=1\cdot2\dot{1}$

Here, while we get the desired E M F, we also secure the necessary amount of current; because with a current passing through a single circuit, the strength is the same at each and every point in that circuit.

An Ampère is for ordinary purposes too large to use as a unit, and it has been found more practicable to use instead a thousandth of an Ampère, under the designation of a Milliampère (expressed frequently by the letters M A).

The next unit for consideration is the Coulomb, which is a current of one Ampère flowing for one second. There is very little to be said on this head. It will be apparent that whereas the Ampère is strength independent of time, the Coulomb is strength enduring for a stipulated time, and is therefore virtually a measure of quantity. We may call it a measure of work-power. Again, as the force necessary to raise one pound through one foot in one second is identical in amount with that necessary to perform the same work in ten seconds, so also is one Ampère lasting one second equal to a tenth of an Ampère lasting ten seconds—that is, one Coulomb.

TRANSITS OF VENUS.

By Richard A. Proctor.

(*Continued from page* 356).

WE have now to consider the circumstances which render the varying position of the conjunction-lines important in connection with transits of Venus.

If Venus travelled in the same level as the earth, she would necessarily be directly between the earth and sun

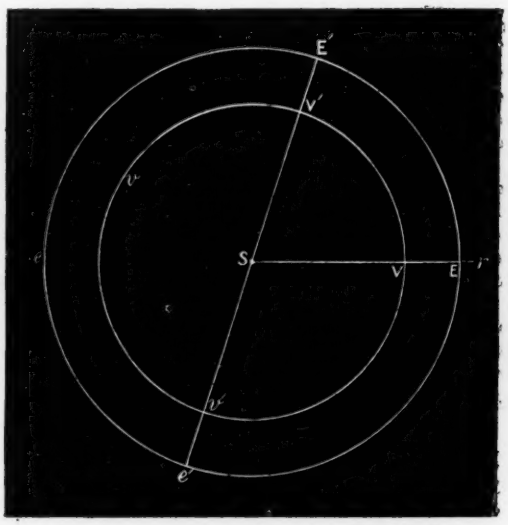


Fig. 2.

when in conjunction, as when the two bodies are at E_1, V_1, or E_2, V_2, or the like. Venus would then be visible, from the hemisphere of the earth which was at the moment turned sunwards, as a black spot centrally placed on the

sun's disc at the moment of conjunction. But although the path of Venus lies *nearly*, it does not lie *exactly*, in the same level as the earth's. Thus, if EE'*e* (Fig. 2) represent the earth's path, while VV'*v* represents that of Venus (E being the place occupied by the earth at the Autumnal Equinox, so that SV is directed to the point in the heavens called the First Point of Aries), then the planes of the two orbits intersect in the line E'*e*'. And if we regard the earth's orbit as lying in the plane of the paper, then the orbit of Venus must be regarded as crossing the plane of the paper at V', passing to its greatest distance above (or north of) that plane at *v* (the actual distance being represented by the short white line at *v*), passing down to the paper again, which it crosses at *v'*, and then passing to its greatest distance below, or south of the plane of the paper, where a short white line is seen near V, and so onwards to its crossing place at V'.

It is manifest, then, that only when Venus is in conjunction with the earth at or near V' (which is called her *ascending node*), or *v'* (which is called her *descending node*), will she be seen upon the sun's face, crossing or *transiting* it as she passes onwards from conjunction. If she is in conjunction when near *v*, she will be above, or north of the sun's disc, by her greatest possible amount; if she is in conjunction when near V (close to the short white line), she will be below or south of the sun's disc by her greatest possible amount. But when in conjunction anywhere on the arc V' *v v'*, she will be more or less above the *centre* of the sun's disc; and when in conjunction anywhere on the arc *v'* V V', she will be more or less below the *centre* of the sun's disc; and she will only transit the disc when she is so near V' or *v'*, as to be *not more than the sun's semi-diameter* above or below his centre.

Let us then inquire within what distance from V or *v'* Venus must be, so that, if in conjunction at the moment, she would be seen upon *some* part of the solar disc. The inquiry is a very simple one, in any case; but to reduce it to its simplest form, we will make the following assumptions:—First, the earth and Venus shall be assumed to be at their mean distances; next, we shall consider only the centres of the two planets, inquiring under what circumstances Venus's centre would be on the sun's face, as seen from the earth's centre at the moment of conjunction.

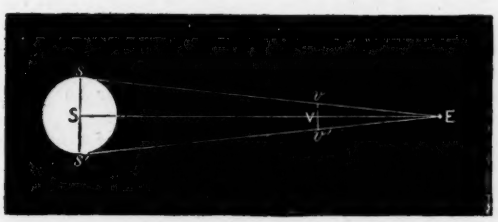


Fig. 3.

We have, then, the following relations:—Let E (Fig. 3) be the earth's centre, S the sun's, V the centre of Venus, when in absolute conjunction, that is on the line E S. Let lines E *s* and E *s'* be drawn from E, to touch the solar globe; then, owing to the sun's enormous distance, *s* S *s'* may be regarded as a straight line, square to E S. Draw another line *v* V *v'*, also square to E S. Then if, when in conjunction, the centre of Venus is anywhere between *v* and *v'*, the centre of the disc of Venus will be on the sun's face.

Now *s* S *s'*, the sun's diameter, contains 852,908 miles, if E S be assumed equal to 91,430,000 miles, as throughout this paper*; and on the same assumption the distance, E V, is 25,296,000 miles. But manifestly *v* V bears to E V the same proportion that *s* S bears to E S. Hence we have the simple rule-of-three statement:—

91,430,000 : 25,296,000 : : S *s*, or 426,454 : V *v*.

Whence V *v* or V *v'* is equal to 117,987 miles.

It follows that if Venus, when in conjunction, has her centre not more than 117,987 miles above or below the line joining the centres of the earth and sun, then Venus's centre, as supposed to be seen from the earth's centre, will be on the sun's face.

Now it is easy to find how near Venus must be to her node in order just to have this limiting distance 117,987 miles from the level of the earth's track. Venus's orbit plane is inclined 3° 23′ 30·8″ to the plane in which the earth travels. Let us suppose that the orbits are looked at from a point in the prolongation of their common line of intersection, so that they appear like two lines, as V S V' and E S E', in Fig. 4. Then the points V and V', where

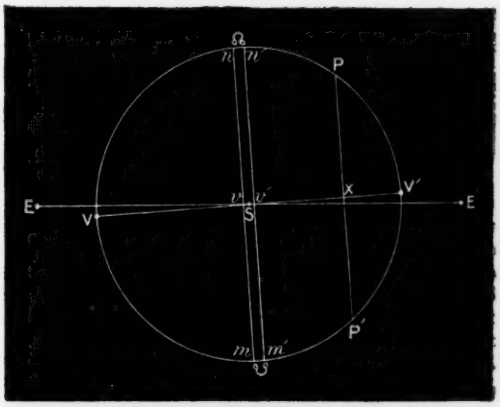


Fig. 4.

Venus has her greatest distance from the plane of the earth's orbit, are easily shown† to be 3,912,807 miles above and below that plane. And when Venus is at any other point of her orbit, as X—corresponding to either P or P' if the orbit be supposed opened out to the circle V P V'—then her distance from the plane of the earth's orbit is less than 3,912,807 miles in precisely the same proportion that S X is less than S V or S V'. But what we want is to determine where Venus must be so that this distance may be 117,987 miles, neither more nor less. If *v* and *v'* on either side of S be the required points (corresponding to the four points *n*, *n'*, and *m*, *m'* in the orbit, where ☊ and ☋ are the nodes) we manifestly have the following rule-of-three sums for determining S *v* or S *v'*:—

3,912,807 : 117,987 : : S V or 66,134,000 : S*v* or S*v'* whence we find that S *v* or S *v'* is equal to 1,994,212 miles. Thus *v v'* is about 4,000,000 miles. And it is clear that each of the arcs *n n'* and *m m'* is very nearly the same in length as *v v'*; for where the arc is small it differs very little from the chord. Hence we have this simple result: If Venus is within 2,000,000 of miles of either node when in conjunction, there is a transit; otherwise not.

* The result is not at all affected by this assumption, which is only introduced in order to make Venus's displacement a question of miles, instead of heliocentric latitude.

† Of course, this distance is equal to Venus's mean distance × sine of her inclination—on our assumption of mean distances. Owing to the small eccentricity of Venus's orbit, this assumption is not far from absolute correctness.

XUM

However, it is convenient to know how many degrees, &c., are contained in each of the arcs $n\,n'$ and $m\,m'$. This is readily calculated, since we know the radius of the circle and the chord of each arc. We find, then, that each arc contains 3° 27′ 21·4″. Thus if Venus, when in conjunction, is within 1° 43′ 40·7″ of either node (always, be it remembered, on our assumption of mean distances) there will be a transit; otherwise not.

Again, adding together the two arcs $n\,n'$ and $m\,m'$, we get 6° 54′ 42·8″ as the total amount of arc of Venus's orbit, along which she must be for a transit to occur when she is in conjunction. Now the complete orbit contains 360°, and 6° 54′ 42·8″ is contained in 360°, 52·08417 times. So that on the average of many conjunctions one transit occurs for 52·08417 conjunctions. As each synodical period contains 583·9204 days, it follows that on the average of long periods of time, one conjunction occurs in 83·26482 years. But this would only correspond to the case where a very large number of conjunctions was considered.*

(To be continued.)

LEAF-COPYING.

By Taranaki, No. I.

I USED Mr. Roberts' process (p. 342) years ago, but never with good results. The following plan is much better:—Take a piece of thin muslin and wrap it tightly round a ball of cotton-wool as big as an orange. This forms a *dabber*, and should have something to hold it by. Then squeeze on to the corner of a half-sheet of foolscap a little colour from a tube of oil-paint. Take up a very little colour on the dabber and work it about on the centre of the paper for some time, till the dabber is evenly covered with a thin coating. A little oil can be used to dilute or moisten the colour if necessary. Then put your leaf down on the paper and dab some colour evenly *over both sides*. Place it then between the pages of a folded sheet of paper (unglazed is best), and rub the paper above it well all over with the finger. Open the sheet, remove the leaf, and you will have an impression of *each side* of the leaf. Any colour may be used. Burnt or raw sienna works the most satisfactorily.

Electric Light Accident.—Much disappointment, says the *Standard's* Vienna correspondent, was created by an accident at Brünn on Sunday night last, where a new theatre was to have been opened, illuminated with the electric incandescent light. It was found that the lead connected with the conducting wires had mostly been melted by the current. A large and fashionable crowd had assembled at the doors of the new building, whom the Burgomaster had to inform that the performance could not take place in consequence of the failure of the electric lights.

* Let us compare the average above deduced with that resulting from the ordinary statement that transits occur at intervals of 105½, 8, 121½, 8, 105½, 8 years, &c. Adding together 105½, 8, 121½, and 8 years we obtain 243 years, the fourth part of which is 60¾ years. Accordingly, it would follow that this is the true average interval between successive transits when a very long period of years is taken into account. But the true average is rather more than 83½ years. The difference arises from the mistaken assumption that when the conjunction-line is passing a node there will always be two transits, separated by a period of eight years. This is not the case, as will be elucidated later.

"MUCH ADO ABOUT NOTHING."

(*Concluded from page* 389.)

WE have but a few words to add to that which want of space compelled us last week to leave unfinished. It will be noticed that in these pages, which do not aim at dramatic criticism generally, only those performances can be noticed which are important not solely because of the subject illustrated, but because their reception by the public tells us something about the culture of our theatre-going public—a matter of some sociological significance. As Herbert Spencer has recently well remarked in America, we hear a good deal of the Gospel of Labour, but the Gospel of Relaxation should also at times be heard of.

And speaking of America, it will be interesting in the light of what we hear respecting the reception given to Mrs. Langtry, to note how an actor and actress like Mr. Irving and Miss Terry are received by trans-Atlantic audiences. If it should appear that crowds rush to see and applaud a lady socially interesting, to minds of a certain order, but unquestionably not a great actress now, nor likely ever to be one (though in scenes where her natural self suffices she retains more of her natural self than most amateurs, being more self-possessed), while they are not interested in anything like the same degree in real dramatic power, then we shall have to admit that our cousins over the water, whatever excellent qualities they may possess, have *as a people* little taste or judgment in matters theatrical; though indeed their dramatic critics have thus far expressed views sufficiently correct.

We referred in our last to the scene between Benedick and Beatrice in the church, because we believe this scene to afford a crucial test of the actors' reading of their several parts. One who considers this scene superficially might consider (as we find many do) that Mr. Irving is right in regarding it as intended to excite laughter. If Benedick and Beatrice are in truth so shallow they should little interest us. Rightly read, there can, we take it, be no doubt whatever that the quaint love-making of Benedick in this scene, the half-sobbing confession of love by Beatrice, should be in no sense suggestive of laughter. He rightly takes her affliction as a motive to speak his love and to proffer his sympathy. She as rightly understands his kindly words. Neither falls entirely out of the old tones. It would have been scarce natural that either should. But there is only so much of that tone left as shows how truthful they both are. Anyone who fails to feel how the thoughts of each are occupied—his with sympathy and hers with sorrow—can never be made to feel as much by explanation or by reasoning.

One other fault (as it seems to us) in the rendering of these parts, and we have done—noting always that the good points far outweigh the errors. We cannot quite approve of the way in which both Benedick and Beatrice applaud their own wit. Beatrice laughs aloud at her own jests. Approved wits do not thus; only those whose jests must be illuminated with laughter or they would pass unnoticed. Even if Beatrice had had this excuse, her laughter would have seemed a little unladylike.

In passing, we would invite attention to the significance of the names Benedick and Beatrice.

A seeming pertness, which is neither Beatrice's nor Ellen Terry's, arises from a change in the acting version. Shakespeare wisely interposed a good deal of conversation in the first scene, between the first words of the Messenger, and Beatrice's "I pray you, is Signior Montanto returned from the wars or no?" she waits to ask her question till all in whom her uncle is specially interested have been spoken of. In Mr. Irving's acting version she breaks in

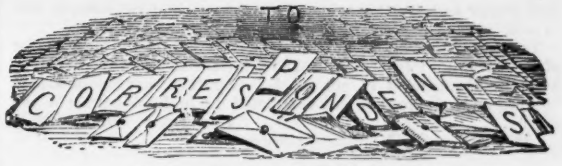
very rudely much earlier. It is impossible for the best actress in the world to correct the bad effect of this ill-advised change. We notice some other departures from the text which seem ill-considered. The parts of Dogberry and Verges are so cut down that the actors have no fair chance in them. The quaint ejaculation of Benedick's, "How now! Interjections? Why, then, some be of laughing, as, ha! ha! he!" is cut down to simply, "How now! Interjections?" which is quite out of character, the quotation from the old grammar rules being just as markedly in character. To have left out the whole sentence would have done well enough; leaving out all that marks the words as Benedick's, reminds one of the change made by an illiterate manager, who, having to abridge an acting version of "Rob Roy," altered Frank Osbaldistone's "My cousin Rashleigh, but for what reason I cannot conceive, my bitterest foe," into simply, "My cousin Rashleigh, but for what reason I cannot conceive!"*

Dr. Jule has been experimenting, with a view to counteracting the bad effects produced by the sulphuric acid, which the combustion of ordinary illuminating gas causes in sufficient quantities to destroy the binding of books and to tarnish the lettering on their backs, besides, of course, vitiating the atmosphere so much that the health of the person breathing it is injured. He suspended two plates of finely perforated zinc, one three and the other twelve inches above the burner. At the end of three months the lower plate showed an accumulation of the ordinary brownish-black deposit and a furring of sulphate of zinc, but the upper plate was only slightly affected. The inference from this examination is that a single plate of perforated zinc, about a foot square, placed over a gas jet is sufficient to retain most of the noxious emanations.

Electric Lighting of Canterbury Cathedral.—A contract has been entered into by the South-Eastern Brush Electric Light Company with the Dean and Chapter of Canterbury to illuminate the Cathedral by the electric light for a period of three months.

A Curious Tree.—Lieutenant Houghton, who has recently visited New Guinea and several other groups of islands in the Pacific, reports the existence of a prehensile tree. It appears to be a species of ficus, allied to the well-known banyan tree, which throws out from its branches air-roots, that eventually reach the ground, and take root there, and in their turn become new stems, which perform the same function; so that a single tree will eventually extend so far as to form a complete forest, in which the stems are united by the branches to each other. The prehensile tree in question similarly throws out from its branches long, flexible tendrils, which, touching the ground, do not take root there, but twine around any article that may lie within their reach. After a time these *quasi* branches contract, so that they fail to reach the ground; but the finger-like processes continue to closely gripe the article round which they have twined themselves, and which are consequently suspended in mid-air. In this way articles of considerable weight may be literally picked up from the ground and held in suspension.

* We may note here a curious blunder in the account given in the *Illustrated London News* of the play as acted by Charles and Mrs. Kean at the Princess's. Referring to a picture obviously describing the masked scene, the writer of the critique, who manifestly had neither seen nor read the play, refers to it as picturing the part of the final scene where Beatrice and Benedick read their "own hands against their hearts." In the folio edition, by the way, Benedick's "Peace, I will stop your mouth," is given to Leonato!



Letters to the Editor.

[The Editor does not hold himself responsible for the opinions of his correspondents. He cannot undertake to return manuscripts or to correspond with their writers. All communications should be as short as possible, consistently with full and clear statements of the writer's meaning.]

All Editorial communications should be addressed to the Editor of Knowledge; *all Business communications to the Publishers, at the Office, 74, Great Queen-street, W.C.*

All Remittances, Cheques, and Post-Office Orders should be made payable to Messrs. Wyman & Sons.

**** All letters to the Editor will be Numbered. For convenience of reference, correspondents, when referring to any letter, will oblige by mentioning its number and the page on which it appears.*

"In knowledge, that man only is to be contemned and despised who is not in a state of transition. . . . . Nor is there anything more adverse to accuracy than fixity of opinion."—*Faraday.*

"Show me a man who makes no mistakes, and I will show you a man who has done nothing."—*Liebig.*

ADVANCE OF SCIENCE.

[622]—In your "Answers to Correspondents" in a recent issue of Knowledge, I see that some one requires a book treating on the advance of science.

Let them try "A Short History of Natural Science." This is a capital book by Miss Buckley, and treats on the subject from the time of the Greeks to the present day. A. Carus Wilson.

COLD BATH AT NIGHT.—LUMINOUS SEA.

[623]—I am not in the medical profession, but can inform A. E. Oram (605, p. 364) that a doctor, who many years ago advised me to take a cold bath every morning, recommended me under no circumstances to do so at night, the body not being then fit to resist the shock. He would himself omit his morning's cold bath if he had been attending a patient during the night. To the cold bath I feel that the preservation of my health and even life is owing.

When in Dunkerque harbour last year, my son amused himself on board while the steamer was waiting to leave by throwing pebbles, &c., overboard, to watch the luminosity, not observable unless the water was disturbed. This corroborates "Florian's" last paragraph (609, p. 364). A. Gaubert.

LUMINOUS SEAS.

[624]—I have seen, when conger-fishing at night off the coast of Finisterre, France, the water phosphorescent to the depth of over a fathom. The arrival of "fish" was announced at that depth by bright flashes of light, caused by the struggling eel disturbing the water. At the depth of three or four feet the fish was coated with the organisms, enabling us to distinguish size and species.

I believe that the amount of light displayed by the phosphorescent organisms depends a good deal on the state of the weather. In foggy weather, it is almost nil and superficial; if the day has been hot and calm, the phosphorescence is very vivid, sometimes covering the "cord" with a coating of fire to the depth of six or eight feet. G. D. Home.

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[625]—It is not the case that they became phosphorescent on the surface alone. I was told by the sailors of the ship that they were believed to extend to a depth of 50 ft. or so, and also to spread over certain parts of the sea in large shoals, covering several miles of sea. They always became phosphorescent on being disturbed, as in the case of a ship passing through, or the instance of the luminous shark, where the sensibility of these organisms must have been great. E. R. Nevill.

THE MILKY SEA AND JOSHUA.

[626]—Mention was made in a back number of the white waters sometimes seen in the Indian ocean.

Any one wishing to read an interesting account of this singular phenomenon should read a book entitled "The Green Land;" and, beyond that account, he will find some most wonderfully graphic descriptions of tropical storms and African coast scenery, which, if

such reader has ever been in those climes, will come home to him as most wonderful word pictures.

Your correspondent John Greenfield falls into the common error of supposing that Joshua wanted to delay the sun's *setting*, whereas he really commanded it not to *rise*, or rather that clouds should obscure its rays, until he had completed the night slaughter of the enemy. PERCIVAL A. FOTHERGILL.

[This last is outside science, however.—ED.]

UNIVERSITY OF LONDON.

[627]—I would strongly recommend "Matriculating Student" (604) to study all the subjects (to the extent required) thoroughly. A specious fallacy in the policy of study is to make the probable requirements of the examination-day the measure of necessary attainments. For books of study, Geddes' "Greek Grammar," Dalzel's "Analecta Græca Minora," Newth's "First Book of Natural Philosophy," and Roscoe's "Elementary Chemistry," if thoroughly mastered, prove more than sufficient. King's College, London, is one of the best teaching institutions for the examination.

FRANK P. MONTH.

[628]—There is a very good Matriculation Examination Class held at St. Bartholomew's Hospital. MEDICUS.

BRAIN TROUBLES.

[629]—May I add my quota to singular experiences of this kind. When tired, or not feeling "fresh" at my work, I find myself sometimes writing "b" for "p," "d" for "t," "v" for "f," and *vice versâ*. Thus I look over a page and find "derifed" for "derived," "fenture" for "venture," "abart" for "apart." Has this confusion been experienced by any of your readers?

G. R. W.

INTELLIGENCE IN FISH.

[630]—The following, which I have just received from a relative, will, I think, show that minnows, small though they be, are not utterly devoid of reasoning powers:—A minnow was put into a bowl which was usually only inhabited by another minnow smaller than itself. Shortly after, the larger minnow was observed driving the smaller one furiously and unceasingly round the bowl, and was, in consequence, taken out and put into a cup of water. Soon after this, it was found that it had jumped out of the cup and was lying on the floor in an almost dying condition. It was however replaced in the cup and afterwards again transferred to the bowl with the other fish, where it has now become as lively as ever, with this difference, that it now always backs away from the little fish as if afraid of it. Perhaps its fishy brain connects its frights and adventures with the little one, and imagines it to be its victor.

E. T. C. W.

A QUERY.

[631]—Will any of your correspondents give the formula used at the Meteorological Office for the reduction of barometric observations to sea-level and to 32° F.? JAS. WATSON, JUN.

LEAF COPYING.

[632]—The article on "Leaf Copying," by J. F. Roberts, in your issue of the 20th ult., has interested me very much. There is only one thing about which I am a little in doubt, and about which I should be glad of a little explanation. What is meant by copying-paper? It can hardly be the paper upon which we take press copies of our letters, as that is never, so far as I am aware, ruled. If you can give me this information in a future number of KNOWLEDGE, I shall be much obliged. R. F.

HOUSE-FLIES ("*Unde et quo*").

[633]—Allow me to ask, through your columns, if you or any of your readers can tell me what becomes of the hosts of flies which we see in the summer time, and which disappear sometimes in a day or two with change of weather. Many of these insects, we know, creep into the cracks and crevices of our houses, during the autumn and winter, hybernate, and come forth with the return of warm weather in their former mature condition. These, however, comparatively few in number, do not account for our midsummer swarms.

I should be glad to learn whether the common house-fly is produced from ova, or whether it is developed within the body of the maternal fly into the maggot stage, as occurs with the blue-bottle?

M. D.

Answers to Correspondents.

*** All communications for the Editor requiring early attention should reach the Office on or before the Saturday preceding the current issue of* KNOWLEDGE, *the increasing circulation of which compels us to go to press early in the week.*

HINTS TO CORRESPONDENTS.—*1. No questions asking for scientific information can be answered through the post. 2. Letters sent to the Editor for correspondents cannot be forwarded, nor can the names or addresses of correspondents be given in answer to private inquiries. 3. Correspondents should write on one side only of the paper, and put drawings on a separate leaf. 4. Each letter should have a title, and in replying to a letter, reference should be made to its number, the page on which it appears, and its title.*

T. A. The effect of condensation is measurable, and greatly falls short of that necessary to produce the intense light. On the other hand, the heat required to effect dissociation and given out when chemical combination takes place is also measurable, and is found to be equivalent to that necessary to produce the light. This being so, can we doubt which is the true theory?—S. M. A very singular coincidence.—AN ADMIRER OF KNOWLEDGE. We wished to insert your letter. But it is not quite fair. You speak of Z wishing to torture prisoners that his own corns or toothaches may be cured, and apply the same sarcasm to Tyndall and Huxley. I doubt if any advocate of vivisection has ever thought of getting cures for his own pains. J. W. WILLIAMS. I suppose there would be a slight difference in favour of the stronger-haired teazels. This would tell in the long run, though many even of these would doubtless be consumed.—P. O. DODD. Please address the publishers on such matters.—M. H. C.—"Gradatim" was asking about the actual glacial periods, not about relative glaciation. The quotation is given as a line, not as a hexameter; if it had been given as in Horace, the passage would have been absurd. It would have read thus:—British earthquakes remind us of the old line, "the mountains are in labour, a ridiculous mouse *will* be born," where we meant "*is* born." That would have been absurd if you will. It was actually to show that the original was not quoted from that the order of the first two words was changed.—EDM. P. TOY. The calculation is given in my "Saturn and its System." But I may shortly give it again here.—TRESILIAN. I am somewhat of your opinion, but originally the papers were to have been fewer.—J. M. S. That quotation appeared in our first number. It sounds a little too assuming for a quotation at the head of our correspondence.—TH. D. Many thanks. We had cut out that passage for quotation, but had not room. There is more to the same effect in this month's "G. MAG." May quote some of that.—GRUB. What a charming *nom de plume!* The invisible vapour of water turns into visible cloud under both conditions. In my article on Fog in Rodwell's "Cyclopædia of the Physical Sciences," I wrote, "Thus a river flowing from a warm to a cold region, will often be covered with fog, because it is colder than the surrounding air, which, becoming cooled below the dew-point, discharges its moisture in the form of fog; but again, a river flowing from a warm to a cold region will also often be covered with fog, because it pours more vapour into the air than can be retained in the invisible form." This last corresponds with the case in your experiment.—J. M. I wish you had repeated your signature; had to search for former answer. The *locus* is the envelope of a series of circles of equal radius, all having their centres on the ellipse. To obtain the equation to this envelope would not be a very simple matter, simply because the equation is one of a rather high order. You get a biquadratic equation, involving the X-coordinate of the original ellipse; and eliminating this (as, of course, also the Y-coordinate) you get the equation required; but what you can do with it when you have it I do not know.—REV. URB. S. You mistake; our omission of religious matter means only that controversial matter is excluded, not that "God cannot be introduced into his works." You will find no such omission either in KNOWLEDGE, or in the works of the writers attacked in the paper we censured. We did not ridicule this last, the case being too serious for ridicule.—C. W. BOURNE. We hope that Col. Keyser may be led to give the true account of what he did, and so correct the absurd statements which have been going the rounds of the papers. Fear we cannot find space for the simple geometrical proof that the circumference of the circle is less than $3\frac{1}{7}$. Whewell gave a similar proof that the circumference exceeds $3\frac{1}{8}$; see De Morgan's "Budget of Paradoxes," p. 417.—A. B. You have gotten a little mixed. Our formula connects r and a, the actual and the mean distance; from it and a known perihelion velocity, you seek to obtain the earth's perihelion distance—a most illegitimate proceeding! The ratio 207 : 208 which comes out is really the ratio between the estimates of the sun's distance used by me and you respectively.—A. F. OSBORNE. I know of no good text-book of astronomy for beginners—those by astronomers who *know* are so unintelligibly written, and those well written are so obviously written by those who do *not* know. We speak, be it noted, of text-books only. In Lardner's Handbook you will find a pleasing

mixture of the two sorts.—O. W. P. Pardon me; I have not put the growth of the oak from the acorn as a proof of the doctrine of evolution. Both are illustrations of the wonderful operation of those laws which the Creator has assigned to his works. You say the acorn is the product of a perfect form. How do you know that? By the result only; for no man can recognise a perfect oak in an acorn. In like manner I find the forms you speak of as immature (though, by the way, the acorn is scarcely a mature article) must be perfect, for they develop to perfect forms.—G. N. Lt.-Col. Sorry for the delay, but between the comet and the transit astronomical matters rather crowd us.—A. F. O. Two comets travelling along precisely the same orbit near the sun would, of course, pursue also the same orbit far from him. But an orbit of great eccentricity, and with perihelion very near the sun, would be changed to one *appreciably* the same near the sun, but very different at a distance from him. Mr. Neison's remark must have been misunderstood by the *Athenæum* writer. It is perfectly correct, of course, but my friend Mr. Neison is not in the habit of announcing that two and two make four.—Jos. Clark. See letter about Rainband Spectroscope in No. 53.—H. W. C. K. (1.) See advertisements as to star maps for November and December. (2.) There is no mistake, either of engraver's or of mine. The signs of the zodiac were all right in their proper constellations two thousand years ago, at about which time, having for two thousand previous years been travelling athwart their constellations, they began to leave them. The cause was and is the precession of the equinoxes. (3.) That method of copying drawings is not suitable for drawings on thick paper.—Dens. I think I can answer that tooth question myself, for, sixteen years ago, I consulted a dentist about just such tiny black marks on a tooth. He scraped them out a little, and filled with gold, and I have had no more trouble with them. It is rather strange, by the way, that all the trouble I have ever had with my teeth began and ended (so far, I mean, as actual mischief was concerned) when I was at Cambridge, whence you write.—P. D. Glad of your kindly words. (1.) It would be difficult to say which pictures in ordinary galleries are "improper." There are paintings from which some turn away as if they were ashamed to look at them which are full of grace and beauty, and perfectly wholesome to healthy minds. I agree with you if you mean the coarse pictures of Bacchanals (hideous beasts!) by N. Poussin, and the like. (2.) Yes, "'allegiance,' 'loyalty,' and 'faith,' have been most nobly exhibited as between man and man, not between corporations, boards, and societies." Allegiance to the state, as the highest form of patriotism, is a worthy quality all the same. But if one sees a Fijian (for example) devotedly loyal (save the mark) to his chief, *because* that person is descended from X., a pirate warrior of some other race, and from Y., another pirate chief of yet another race (who perhaps conquered X.'s descendants, but married with a female representative), each descent being traceable through twenty generations along a line including nine or ten murderers, ten or twelve imbeciles, a few bastards, and some casual lunatics by intermarriages with neighbouring Polynesian races of more savage origin still, *then* science recognises a most interesting problem in tracing the growth and development of this most preposterous Fijian superstition. Yet a Fijian of twenty generations back, fighting for his chief and cheerfully giving up his life to save that of the leader of his people, showed true loyalty, and deserved to be held in loving remembrance by all his tribe—so greatly do circumstances alter cases.—R. H. A. Those lottery schemes are as honest as such schemes can be; that is, they are quite rascally. You know your chances and take them, and the company pockets assured profits, having not benefited but injured their kind.—H. Comberg. The effect of repeated doublings is indeed great; but I think it is pretty well known.—R. Waugh. My lecture has not been published.—Alfd. Dray. Better observe when the pole-star is just above or just below the pole; or else just to right or left, correcting for the star's distance from the pole. In my "Easy Star Lessons" the times when the pole-star is in these positions are given.—W. J. Palethorpe. Do not know the weight of the large mirror of the Rosse telescope, or of the Princeton lens. The diameter of the great mirror of the former instrument is 8 feet.—M. C. S., will be obliged to any correspondent giving information respecting the so-called caterpillar-tree of New Zealand. We have seen it, and been told much about it; but our informant was not scientific.—E. S. Purcell. Thanks.—Enitor ut Vincam, H. W. L. (?), A. A., Grisel. I believe you can always get Hamiltonian translations of Latin works at secondhand bookstalls. They explain themselves. You read on till you find yourself falling into the swing of the language and catching its idioms—it is just as if you heard the language spoken, and were told its meaning—just, in fact, as you pick up a foreign language when you live among those who speak it. Then you begin to combine this process with the study of the grammar—such simple books as Arnold has written, not the ridiculous books devised to perplex unhappy beginners. You gradually extend your vocabulary; but by reading, not by wearing out dictionaries. You will be told that this easy way of learning is not so good for you as the old-fashioned way, which reverses the usual order, and sets you learning rules before you know what they are about. It is not what a boy is told, said a learned idiot, but what he teaches himself, that is of use to him; whereunto the Rev. Sydney Smith rightly made answer, that one might as well say it is not the clothes a boy puts on that covers his nakedness, but those he makes for himself. I can only say, that having occasion thirteen years ago to review a German book, and knowing practically nothing of German, I bought four or five Hamiltonian books of German in Holywell-street, reviewed that work in less than a fortnight, after reading and enjoying it (the review appeared in *Nature*, and was republished in my "Light Science for Leisure Hours,") and that ever since I have been able to read any German prose I have yet come across, with such occasional aid from a dictionary as is rendered necessary by defects in my German vocabulary. A German grammar I found exceedingly interesting *after* I had thus got the swing of the language.—F. Chapman. If x = number of bullocks, y = number of sheep, and z = number of pigs, you have (using the half-sovereign as coin unit)

$$20x + 6y + z = 200$$
$$x + y + z = 100.$$

whence $19x + 5y = 100$, an indeterminate equation as it stands, but determinate if combined with the condition that x and y are both positive whole numbers, neither being zero. For it is obvious that x *must* be a multiple of 5, and cannot be a greater multiple than 5 itself, for if x were 10, y would be negative. Therefore, $x = 5$, whence $y = 1$, and $z = 94$; making the total price paid for the bullocks £50; for the sheep, £3; and for the pigs, £47.

ELECTRICAL.

H'sett. — Very ingenious. Terrestrial magnetism is to all appearance the result of electric currents. Magnetism can scarcely be substituted for gravitation, because—if for no other reason—gravitation is an attractive force, exerted by all forms of matter in proportion to the bulk, but irrespective of chemical or physical constitution.—A. W. L. The slope is of no importance, and is only made for the sake of appearance, etc.—G. McIntosh. 1. Anent lead filings, try the experiment and see how it answers, but lead is the ultimate condition of the peroxide. Might not the heavy filings tear the spongy lead away? 2. Better use felt or asbestos, not cardboard. 3. Quantity and intensity are terms which have served a good purpose, but are now dying out. The fourth article on "Measurement" should help you to understand them, but another article is to follow, which, as it may remove your difficulty, please see. 4. The intensity or E.M.F. of secondary batteries is dependent on their constituents and independent of the charging current. A current of low E.M.F. may be transformed into one of high E.M.F. by charging the accumulators in parallel circuit or quantity, and discharging them in series. 5. You were right in connections, as the discharging current is opposite in direction to the charging current. 6. The E.M.F. of a dynamo varies as the number of revolutions made by the armature, and the intensity of the magnetic field affects the amount or strength of the current. 7. Don't quite see what you mean. 8. A motor, generally speaking, requires a current of low E.M.F. The little Griscom takes 12 volts. 9. I should not, under any circumstances, recommend Bennett's battery. Its E.M.F. is 1·5 to 1·8. It polarises like the Leclanché, and the recovery is slower than in that battery. Try Higgin's Bichromate battery.—H. W. H. Use white wax instead of the varnish.—Errol (?). Let me know the resistance of your battery.—R. O. The sounds may have resulted from indifferent insulation, considering the relatively high E.M.F., the "cracking" probably being caused by the passage of minute sparks between the wire and the frame of the instrument. The variations of the current were evidently too rapid to affect the galvanometer.

After Dryden.

"Three Pens for three essential virtues famed,
The *Pickwick*, *Owl*, and *Waverley* were named,
The first in flexibility surpassed,
In ease the next, in elegance the last.
These points united with attractions new,
Have yielded other boons, the *Phaeton* and *Hindoo*."

Sample Box, with all the kinds, 1s. 1d. by Post.

"Let those write now who never wrote before;
And those who always wrote now write the more."—*Oban Times.*

Patentees of Pens and Penholders.
MACNIVEN & CAMERON, 33, Blair-street, Edinburgh.
Penmakers to her Majesty's Government Offices. (Est. 1770.)

XUM

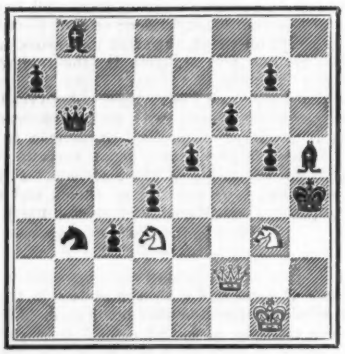
Our Chess Column.

By Mephisto.

REPRINT PROBLEM.

By Eichstadt.

Black.



White.

White to play and mate in four moves.

1. Kt KB5 (ch)
K Kt5 best.

This is the problem which contains an idea similar to that embodied in the fine composition by John Simpson (Problem No. 54). We present it to our readers as a three-mover.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

Leonard P. Rees.—The problem you sent has already been in type for some time. We do not think it advisable to invite solvers to review the problems; such a course is bound to create bad feeling.

C. W. C.—It is our intention to have a problem every week, but "Mephisto" proposes and Editor disposes.

S. S.—Problem received; but without solution. All problems sent for publication must have the solution and the name and address of the composer written on the back of the diagram.

C. Hammick, John W. Fowler. — Problem received, will be examined in due course.

Correct solutions of Problem No. 59 received from Schmucke, John Watson, C. W. Crosskey, H. V. T., W. C. Thomas, John Alex. Ollard, G. Woodcock, Geo. H. Bonner, W. J. Reynolds, T. T. Dorrington, R. J. P., J. K. Milne, E. C. H., Berrow, Rev. C. C., W. Powell, T. S. L., C. S. Bright.

Paired for correspondence game: G. Woodcock *v.* G. H. T., Alfred B. Palmer *v.* R. Pilkington.

Our Whist Column.

By "Five of Clubs."

ILLUSTRATIVE GAME.

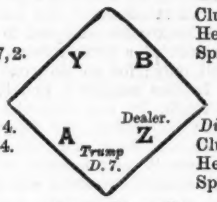
EDITOR SHOWS HOW NOT TO DO IT.

DEAR FIVE,—The game referred to in query answered by you, p. 347, and in the last two letters of our correspondence last week, ran as follows. It was played later in the evening than the one given at p. 367; but, as you justly said in your reply, my carelessness was hard on my partner, as we must have made five by cards had I played correctly, even *after* overlooking his indication of the number of trumps he held. But the game will be instructive, I think. Criticise it in plain words.—Yours faithfully,

Editor.

The Hands.

Y.	B.
Diamonds—Q, Kn.	*Diamonds*—A, 10, 8, 2.
Clubs—10, 5.	Clubs—A, Q, 9.
Hearts—8, 7, 5, 3.	Hearts—Q, Kn, 10, 9, 6.
Spades—K, Kn, 10, 7, 2.	Spades—A.

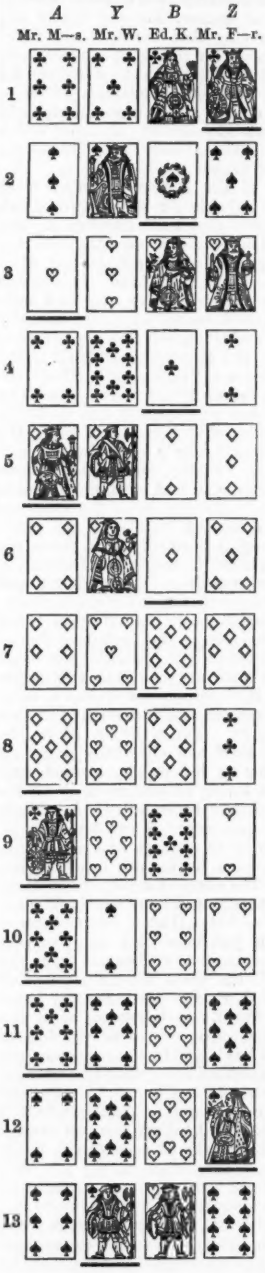


A.	Z.
Diamonds—K, 9, 6, 4.	*Diamonds*—7, 5, 3.
Clubs—Kn, 8, 7, 6, 4.	Clubs—K, 3, 2.
Hearts—A.	Hearts—K, 4, 2.
Spades—6, 4, 3.	Spades—Q, 9, 8, 5.

Score: Love all.

THE PLAY.

Note.—The card underlined wins the trick, and card below leads next round.



REMARKS, INFERENCES, &c.

1. *A* rightly opens his long suit, leading the penultimate. Unless some one is signalling, *B* perceives that *Z* must hold either two out of the three cards below the Six, or all three if *A* has not led from a five-card suit. He finesses the Queen as a matter of course.

2. *Z*'s suit is shown.

3. *B* properly opens his long suit, and is fortunate enough to see it established in the first round.

4. *A* completes the penultimate signal. *Z* must hold the Three; *Y* has no more; therefore, *A*'s Clubs are established.

5. *B* properly leads Trumps his own suit and his partner's being both established.

6. *A* rightly returns the lowest.

7. *B* should now be certain that the enemy's trumps are exhausted; but whether they were exhausted or not, his proper lead would now have been from his established Heart suit. This would have forced out the last hostile trump, however the Hearts lay: and then, the long trumps bringing in the lead again, *A* would have made all the remaining tricks with his Clubs. Putting aside *A*'s showing, in tricks six and seven, that he held originally four trumps (or he would have returned the Six) the case illustrates well the use of the force. For we see that even if the best trump had remained with *Z*, it could have been forced out, and the game won by cards. The only explanation of his bad play is that the triumphant aspect of matters, after trick five, caused our Editor's attention to nod for a moment, and so he suffered a won game to slip from him.* The rest of the game plays itself.—Five of Clubs.

* It is ever thus! The spur of difficulty is needed by most of us, to keep us on the alert. Kaiser, of Leyden, counting nearly 90,000 rotations of Mars to determine the Martian day, easily sets right all the really difficult parts of his problem, correcting even at last for the aberration of light, the effect of which, lost among so many rotations, is as nothing; and then, nodding, forgets that the years 1700 and 1800 were not leap years, and counts two whole days too many. Take care of things easy: things difficult take care of themselves (the proverb is to be patented).—Ed.